React State Management with Redux

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Where is The Code?

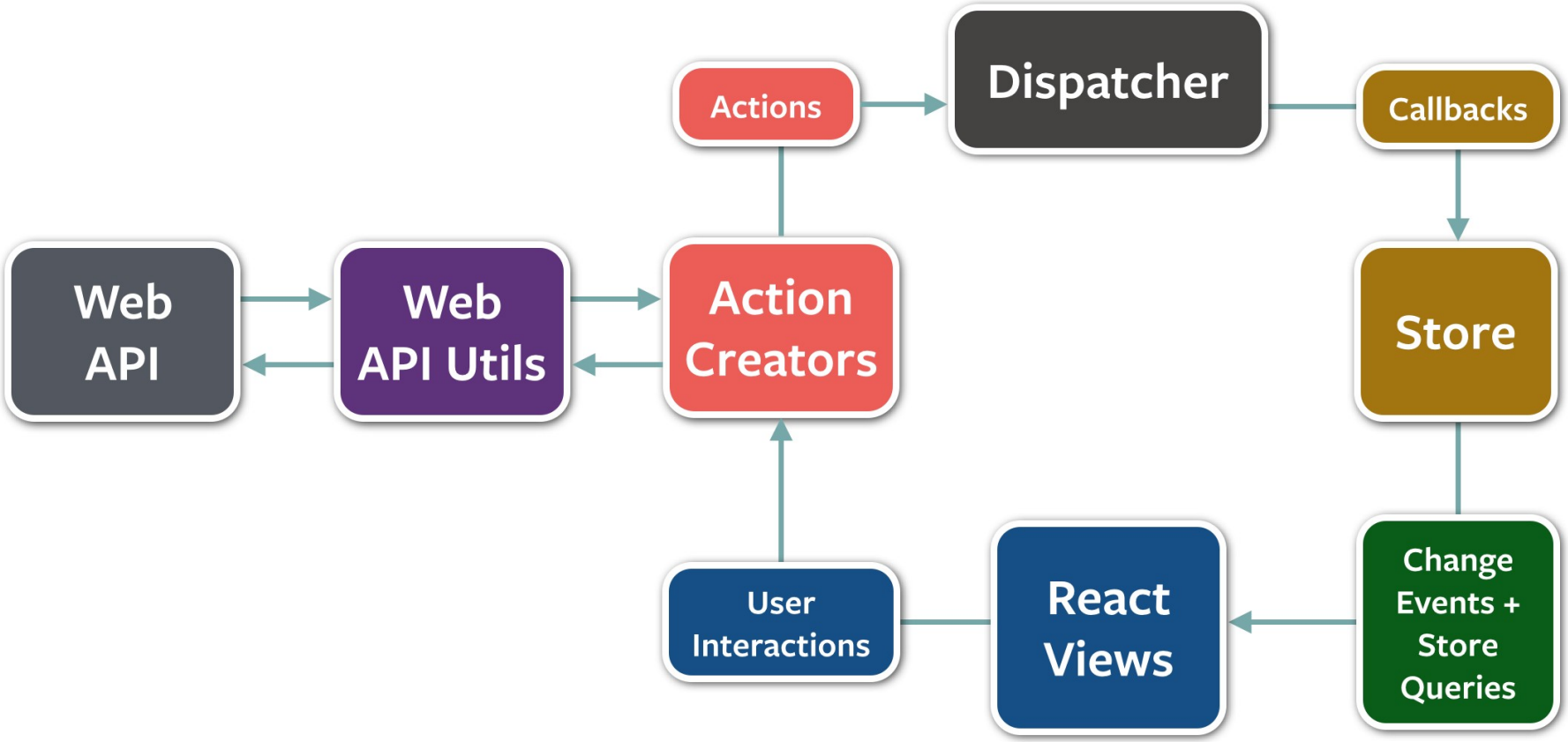
React.js Web App code is available @GitHub:

https://github.com/iproduct/course-node-express-react

Demos:

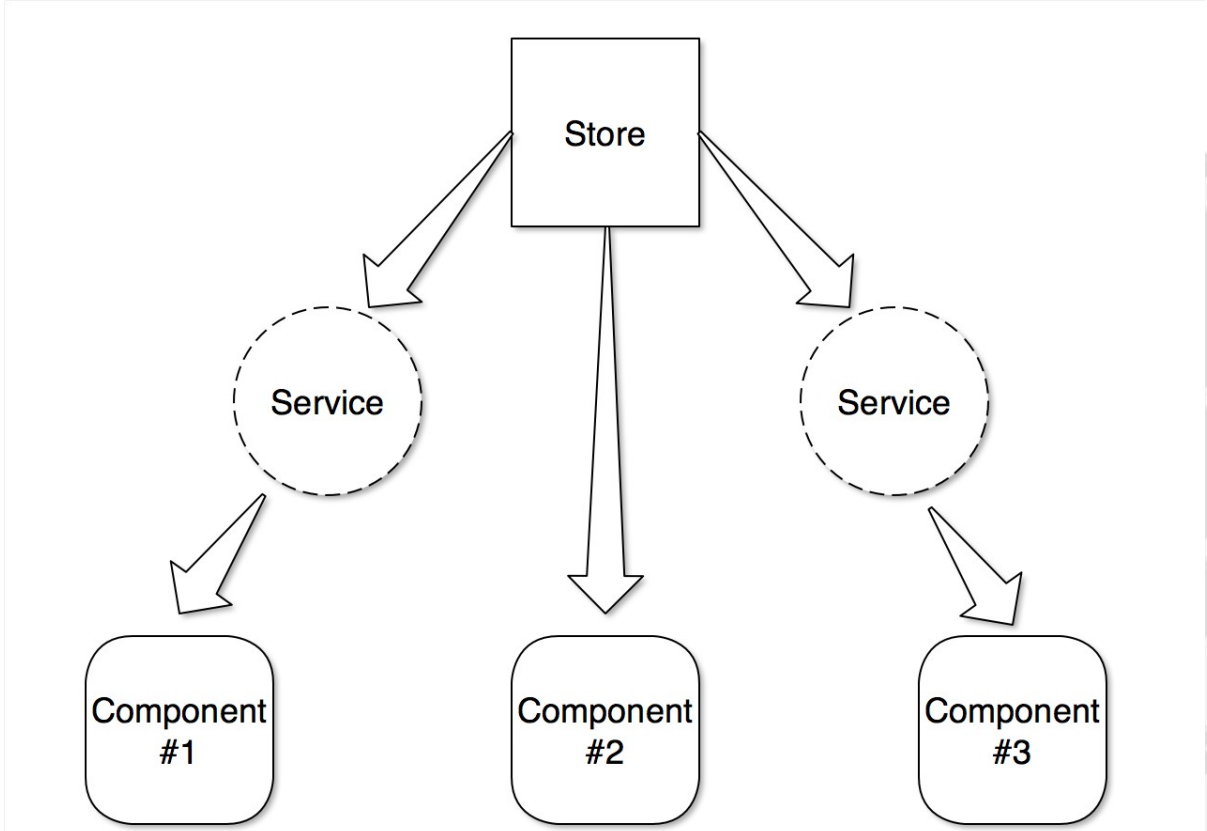
- **16-react-todos-redux** – basic Redux demo
- **17-react-todos-redux-es7-decorator** – demo using @connect ES7
- **18-react-router-redux** – React + Redux + Router + Thunk (async actions) integration

Flux Design Pattern



Source: Flux in GitHub, https://github.com/facebook/flux, License: BSD 3-clause "New" License

Redux Design Pattern



Linear flow: **Dispatch** → **Reducers** → **New State** → **Store**

Source: @ngrx/store in GitHub, https://gist.github.com/btroncone/a6e4347326749f938510

Redux

- Streamlined state management for **React.js** applications, inspired by **Redux**
- **State** is a single immutable data structure
- **Actions** describe state changes
- Pure functions called **reducers** take the previous state and the next action to compute the new state
- State is kept within single **Store**, and accessed through sub-state **selectors**, or as Observable of state changes
- Components are by default perfomance optimized using the shouldComponentUpdate() → performant change detection

Source: @ngrx/store in GitHub, https://github.com/ngrx/store,
License: MIT

Redux Recommended (Basic) Project Structure

- **actions** – action creator factory functions (design pattern Command)
- **assets** – static assets (css images, fonts, etc.) folder
- **components** – simple (dumb) react components – pure render
- **container** – Redux Store aware (smart) component wrappers
- **reducers** – the only way to advance state:

function(OldStoreState, Action) => NewStoreState // = Rx **scan()**

- **index.js** – bootstraps app providing access to Store for all containers (smart components) using React context

Source: @ngrx/store in GitHub, https://github.com/ngrx/store,
License: MIT

Bootstrapping Redux App – index.js

```
import React from 'react';
import ReactDOM from 'react-dom';
import { Provider } from 'react-redux';
import { createStore } from 'redux';
import rootReducer from './reducers';
import { FilteredTodoApp } from './containers/filtered-todo-app';
const store = createStore(
  rootReducer, window.__REDUX_DEVTOOLS_EXTENSION__ &&
               window.__REDUX_DEVTOOLS_EXTENSION__() );
const render = (Component) => {
 ReactDOM.render(
    <Provider store={store}>
     <FilteredTodoApp />
    </Provider>,
     document.getElementById('root')
 );
};
```

Redux store provider

Top level container component

Redux Action Creators – /actions/index.js

```
let nextTodoId = 0;
export const addTodo = (text) => ({
  type: 'ADD_TODO',
  id: nextTodoId++,
  text
});
export const setVisibilityFilter = (filter) => ({
  type: 'SET_VISIBILITY_FILTER',
  filter
});
export const changeStatus = (id, status) => ({
  type: 'CHANGE_STATUS',
  id,
  status
});
...
```

Action Type

Action Payload

Redux Reducers – /reducers/todo.js

```
const todoReducer = (state = {}, action) => {
  switch (action.type) {
  case 'ADD_TODO':
    return {
      id: action.id,
      text: action.text,
      status: 'active'
    };
  case 'CHANGE_STATUS':
    if (state.id !== action.id) {
      return state;
    }
    return Object.assign({}, state, { status: action.status });
  default:
    return state;
  }
};
```

Redux Reducers – /reducers/todos.js

```
const todosReducer = (state = [], action) => {
  switch (action.type) {
  case 'ADD_TODO':
    return [
      ...state,
      todoReducer(undefined, action)
    ];
  case 'CHANGE_STATUS':
    return state.map(todo =>
        todoReducer(todo, action)
      );
  case 'DELETE_TODOS':
    return state.filter(todo =>
        todo.status !== action.status
      );
  default:
    return state;
  }
};
```

Redux Root Reducer – /reducers/index.js

```
import { combineReducers } from 'redux';
import todos from './todos';
import visibilityFilter from './visibilityFilter';

const rootReducer = combineReducers({
  todos,
  visibilityFilter
});

export default rootReducer;
```

Redux Containers – /conatiners/visible-todo-list.js

```
const getVisibleTodos = (todos, filter) => todos.filter(
  todo => filter === 'all' ? true: todo.status === filter);
const mapStateToProps = (state) => ({
  todos: getVisibleTodos(state.todos, state.visibilityFilter)
});
const mapDispatchToProps = (dispatch) => ({
  onCompleted: (id) => {
    dispatch(changeStatus(id, 'completed'));
  },
  onCanceled: (id) => {
    dispatch(changeStatus(id, 'canceled'));
  }
});
const VisibleTodoList = connect(mapStateToProps, mapDispatchToProps
) (TodoList);
export default VisibleTodoList;
```

Redux App using ES7 @connect Decorator

```
const getVisibleTodos = (todos, filter) => todos.filter(
  todo => filter === 'all' ? true: todo.status === filter);
const mapStateToProps = (state) => ({
  todos: getVisibleTodos(state.todos, state.visibilityFilter)
});
const mapDispatchToProps = (dispatch) => ({
  onCompleted: (id) => {
    dispatch(changeStatus(id, 'completed'));
  },
  onCanceled: (id) => {
    dispatch(changeStatus(id, 'canceled'));
  }
});
@connect(mapStateToProps, mapDispatchToProps)
export default class TodoList extends React.Component {
  constructor(props) { ...
```

Using Redux Router Redux and Redux Thunk (1)

- Idea: **history** + **store (redux)** → **react-router-redux** → **enhanced history** → **react-router**

```
import { compose, createStore, combineReducers, applyMiddleware } from
  'redux';
import { Provider } from 'react-redux';
import createHistory from 'history/createBrowserHistory';
import { ConnectedRouter, routerReducer, routerMiddleware, push } from
  'react-router-redux';          // React Router to Redux integration
import thunk from 'redux-thunk'; // Allows using thunks = async actions
import reducers from './reducers'; // your reducers here
const history = createHistory();   // use browser History API
// middleware for intercepting & dispatching navigation & async actions
const middleware = [routerMiddleware(history), thunk];
// Enable Redux Devtools
const composeEnhancers = window.__REDUX_DEVTOOLS_EXTENSION_COMPOSE__ ||
  compose;
```

Using Redux Router Redux and Redux Thunk (2)

```
const store = createStore(
  combineReducers({ ...reducers,
    router: routerReducer // Add the reducer to store on `router` key
  }),
  /* preloadedState, */
  composeEnhancers( applyMiddleware(...middleware) ));

store.dispatch(push('/repos/react/redux'));//dispatch navigation action

ReactDOM.render(
  <Provider store={store}>//ConnectedRouter use store from the Provider
    <ConnectedRouter history={history}>
        <App />
    </ConnectedRouter>
  </Provider>,
  document.getElementById('root')
)
```

Redux Thunk Async Actions - /actions/counteer.js

```
export function increment(x) {
  return { type: INCREMENT, amount: x }
}

export function incrementAsync(x) {
  return dispatch => //Can invoke sync or async actions with `dispatch`
    setTimeout(() => { dispatch(increment(x));  }, 2000);
}

export function incrementIfOdd(x) {
  return (dispatch, getState) => {
    const { counter } = getState();
    if (counter.number % 2 === 0) return;
    dispatch(increment(x));  //Can invoke actions conditionally
  };
}
```

Advanced Redux using Middleware Libraries

- Normalizr – normalizing and denormalizing data in state, helps to transform nested JSON response structures into a relational DB-like plain entities, referenced by Id in the Redux store.
- redux-thunk – in addition to plain actions, Action Creators can now return **Thunks** – callback functions of dispatch and getState arguments, allowing to handle async operations like data fetch from REST endpoint and Promise-like composition.
- redux-promise/ redux-promise-middleware – thunk alternatives
- redux-observable – really powerfull reactive transforms of async action events as RxJS Observables, called **Epics**:

(action$:Observable<Action>, store:Store) => Observable<Action>

Thanks for Your Attention!

Questions?